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Experiment Station Work,

XIV.

INFLUENCE OF SALT AND SIMILAR SUBSTANCES ON SOIL MOISTURE.
EXTRA-EARLY POTATOES.
ROTTING OF CRANBERRIES.
CHESTNUTS.
LOW-GRADE PARIS GREEN.
CRUDE PETROLEUM AS AN INSECTICIDE
SKIM MILK IN BREAD MAKING.
BEST NUMBER OF HENS IN ONE PEN.
NEST BOX FOR EGG RECORDS.
PROFITABLE AND UNPROFITABLE COWS.

PREPARED IN THE OFFICE OF EXPERIMENT STATIONS.
A. C. TRUE, Director.

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CONTENTS OF THE SERIES OF FARMERS' BULLETINS ON EXPERIMENT STATION WORK.

EXPERIMENT STATION WORK

Editor: W. H. BEAL.

CONTENTS OF No. XIV.

ILLUSTRATIONS.

EXPERIMENT STATION WORK—XIV.[1]

INFLUENCE OF SALT AND SIMILAR SUBSTANCES ON SOIL MOISTURE.

The belief is common that the moisture conditions of soils may be materially modified by the use of appropriate fertilizers, more especially by the application of common salt. It is claimed that by the use of such substances the power of the soil to collect and retain moisture can be increased to such an extent as to make this means of controlling the water supply of the soil of practical utility. These claims have been based largely, if not entirely, on theoretical considerations. For this reason the Kansas Station several years ago undertook an extended series of experiments on this subject. Some of the results of this investigation have recently been reported. The experiments were of two kinds—(1) with pots to determine the influence of the different substances on evaporation only, and (2) with small plats of ground to determine their influence on evaporation, drainage, and other factors.

The substances experimented with in pots included muriate of potash, salt, magnesium chlorid, sulphate of potash, kainit, carnallite, and superphosphate at the rate of 904 pounds per acre, slaked lime at the rate of 12 bushels per acre, and barnyard manure at the rate of 28 tons per acre. In the plat experiments the substances used were muriate of potash, salt, magnesium chlorid, sulphate of potash, sodium nitrate, potassium nitrate, ammonium sulphate, superphosphate, and gypsum at the rate of 500 pounds per acre, lime and wood ashes at the rate of 2,000 pounds per acre, and manure and leaf mold at the rate of 40,000 pounds per acre.

[1] This is the fourteenth number of a subseries of brief popular bulletins compiled from the published reports of the agricultural experiment stations and kindred institutions in this and other countries. The chief object of these publications is to disseminate throughout the country information regarding experiments at the different experiment stations, and thus to acquaint our farmers in a general way with the progress of agricultural investigation on its practical side. The results herein reported should for the most part be regarded as tentative and suggestive rather than conclusive. Further experiments may modify them, and experience alone can show how far they will be useful in actual practice. The work of the stations must not be depended upon to produce "rules for farming." How to apply the results of experiments to his own conditions will ever remain the problem of the individual farmer.—A. C. TRUE, Director, Office of Experiment Stations.

These experiments in general "showed no decided effect from the fertilizers except with the plat to which unleached ashes were applied, which lost water more readily than any of the others."

Wollny, a German authority on this subject, has made a long series of similar experiments in pots, using sodium chlorid (salt); muriate of potash; ammonium chlorid; calcium chlorid; magnesium clorid; nitrate of soda; the sulphates of potash, soda, ammonia, and magnesia; carbonate of potash; and acid phosphates of potash and lime (superphosphate) at rates of 445 to 891 pounds per acre. He concluded from his experiments that the soluble salts used increase the water supply of the soil and lessen the amount of moisture given off (transpired) by plants, but that these effects of the salts are of no benefit to the plant, because the increased growth due to the application of the salts uses more water than the soil gains as a result of the application of the salts. Moreover, he says, in dry weather, when the moisture of the soil is of most importance, the soil solutions are liable to become so concentrated by evaporation as to partially or completely prevent the taking up of water by the roots of plants. In the investigator's opinion, therefore, the benefit which on theoretical grounds would be expected from the application of soluble salts to the soil is not as a rule realized in practice.—THE EDITOR.

METHODS OF SECURING EXTRA-EARLY POTATOES.

One of the most important factors having an influence on the profitableness of market garden crops is that of earliness. A difference of two or three days or a week in placing a crop on the market often makes the difference between profit and loss, and the prices obtained for extra-early crops have stimulated cultural experiments with every kind of fruit and vegetables. Some interesting results along this line with potatoes have recently been reported by the Kansas and Rhode Island stations.

At the Kansas Station seed tubers of four different varieties of medium-sized potatoes were placed in shallow boxes with the seed ends[1] up in February. They were packed in sand, leaving the upper fourth of the tubers exposed, and the boxes were placed in a room with rather subdued light, having a temperature of 50° to 60° F. Vigorous sprouts soon pushed from the exposed eyes. The whole potatoes were planted in furrows in March in the same position they occupied in the boxes. The same varieties of potatoes taken from a storage cellar were planted in parallel rows. The sand-sprouted potatoes took the lead from the start in vigor and strength of top and produced potatoes the first of June, a week earlier than the storage-cellar potatoes. At the final digging they showed better potatoes and gave a 10 per cent larger total yield.

In another experiment part of the potatoes was treated the same as

[1] The ends which are crowded with eyes.

in the first test, except that the sand was kept moistened, and the other part was placed in open boxes and kept in a light room having a temperature of 50° F. The tubers placed in sand developed strong sprouts and nearly all rooted. When planted in the field they outstripped both the tubers sprouted in open boxes and the storage-cellar tubers in vigor of growth. The tubers started in the open boxes gave earlier yields than were obtained from the storage-cellar tubers, but not as early as the tubers sprouted in moist sand. The tubers sprouted in moist sand produced table potatoes from 7 to 10 days earlier than the storage-cellar seed.

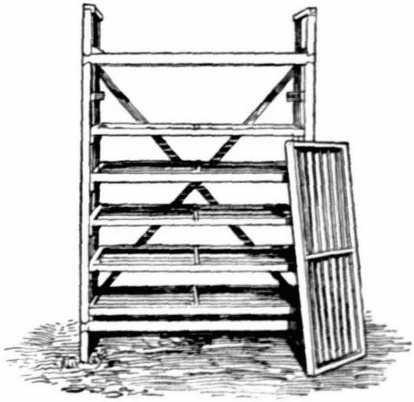

Fig. 1.—Trays and racks for sprouting potatoes.

At the Rhode Island Station medium-sized whole potatoes sprouted on racks, in a fairly warm and light room, gave a 27 per cent better yield at the first digging than potatoes kept in a cold cellar until planting time; and this was increased to 40 per cent at the final digging. The percentage of large tubers was also greater at each digging with the sprouted tubers.

The results of these experiments are suggestive. The handling of seed potatoes in such manner as to secure strong, stocky sprouts before the tubers are planted out, is shown to be an important factor in increasing both the earliness and the total yield of the crop. By planting only well-sprouted seed, a full stand is assured.

One of the objections to this method of growing potatoes is the large amount of space required for exposing the tubers to the light for sprouting. This objection has been overcome in part by the use of trays and racks. At the Rhode Island Station the rack used held 9 trays. Each tray was $3\frac{3}{4}$ feet long and $1\frac{1}{2}$ feet wide, and would hold about 1 bushel of potatoes when spread out in a single layer for sprouting. The bottoms of the trays were made of pieces of lath placed about 1 inch apart. Nine trays were placed in a rack over each other, leaving about 9 inches of space between each tray. This method of arrangement has the advantage of securing a very uniform distribution of light, heat, and air for all the trays. It greatly facilitates the handling of the potatoes and lessens the danger of breaking off the sprouts when transferring to the field for planting. The illustrations

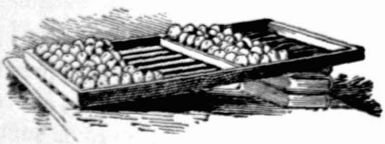

Fig. 2.—Tray partially filled with potatoes for sprouting.

(figs. 1 and 2) show the construction of the trays and rack used at the Rhode Island Station and the position of the potatoes in the trays.

Another method of securing early potatoes in Rhode Island on a commercial scale is that of sprouting tubers in a cold-frame and planting out as soon as danger of frost is past. The tubers are cut into pieces, not smaller than an English walnut, after rejecting the two or three eyes nearest the stem end, which have been found to start late. The pieces are placed side by side in the bed, skin side upward, and covered about 4 inches deep with fine, rich earth. Their growth can be controlled by proper regulation of the cold-frame sash. At planting time the tubers, the sprouts of which should be just breaking the surface of the soil, are carefully lifted with manure forks, separated by hand, and placed in well fertilized rows, and entirely covered with soil;

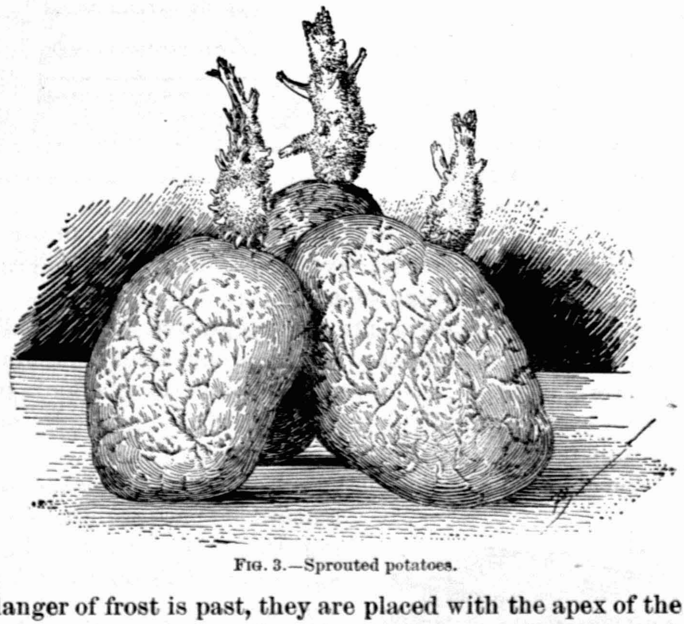

FIG. 3.—Sprouted potatoes.

or, if danger of frost is past, they are placed with the apex of the sprout just at the surface of the soil. About 216 square feet of cold-frame is required to sprout sufficient potatoes to plant an acre in 30 to 32 inch rows, 12 inches apart. Eight men can transplant an acre in a day.

On the Island of Jersey, where early potatoes are raised in large quantities for the London market, the potatoes destined for seed are placed side by side in shallow boxes and stored, as soon as cold weather sets in, in a light and well-sheltered loft or shed, out of danger of frost. The position of the boxes is changed from time to time so that the sprouts will be of equal length and strength at the planting season. A typical sprout (see fig. 3) averages about one-half inch in length. Medium sized tubers selected from the best of the crop and allowed to lie in the field in the fall until they become greenish are used.

Potatoes for early use are sometimes started in pots in the green-

house and then planted out as soon as danger of frost is over. The cost incident to this method limits its use, except for family supply.—C. B. SMITH.

THE ROTTING OF CRANBERRIES AND A PROPOSED REMEDY.

According to the New Jersey Station, cranberry growers in that State sometimes meet with "difficulty in the shape of their berries rotting on the vine in whole areas, at a time when other and neighboring areas are producing an abundance of whole and healthy fruit." Analyses of samples of the soil of bogs producing healthy and unhealthy fruit and of the vines and fruit showed that the bogs on which the berries rotted contained less clay and silt (and iron and alumina) and more nitrogen than those which produced sound berries. The vines which produced rotten fruit contained less phosphoric acid and potash than those which bore good fruit. The analyses of the rotten fruit also indicated that potash and phosphoric acid and, to a smaller degree, lime are essential to a healthy growth of the cranberry.

In view of these results, together with the good effects from the addition of clay to many bogs, which contributes to both their mechanical and chemical improvement, the station suggests that in the case of rotten bogs a liberal application of phosphoric acid and potash might, in part at least, correct the deficiencies which are shown to exist in the soils and vines from bogs producing rotten fruit, the phosphoric acid to be drawn preferably from natural guanos, or from basic slag phosphate and the potash to be in the form of a sulphate.

—THE EDITOR.

CHESTNUTS.

CULTURE.

Considerable activity has manifested itself in comparatively recent years relative to the commercial culture of chestnuts. The steady demand for large nuts and the ready sale of these in competition with smaller sorts has stimulated culture experiments with the large nutted European and Japanese varieties by horticulturists in a number of States. The stations have called attention to this work from time to time and have urged the value of systematic culture of chestnuts, especially in the utilization of waste forest lands, as a valuable supplementary crop for farmers. A monograph on nut culture in the United States, published by the Division of Pomology in 1896, includes a very full treatment of the subject of chestnut culture. In a recent bulletin from the Delaware Station, the history, uses, culture, botany, enemies, value, and present status of European and Japanese varieties in the eastern United States are especially considered, and in a report from the Connecticut State Station the results of experiments in chestnut grafting are given. From these and other station and Department sources the following summary has been prepared:

Chestnuts are found native in America from Maine on the north to Michigan and Tennessee on the west, and Louisiana and Georgia on

the south. European chestnuts were first grown in this country in the early part of the nineteenth century. Japanese chestnuts were introduced at a much later period. The first importations are said to have been made about 1876. The advent of the Japanese nut, with its large size, early bearing propensities, and complete union on either its own or American-grown seedlings or native American stocks, at once attracted the attention of prominent horticulturists to the possibilities of a new and desirable industry. As a result both groves and orchards have been set out in the Eastern States and California; covering, in some instances, more than 100 acres in extent and numbering thousands of trees.

Chestnuts are usually propagated from seed and the stocks later grafted or budded with improved varieties. Seed for this purpose can be planted in the fall soon after the nuts are ripe, or kept over until spring and then planted in the seed bed in light sandy soil or pure leaf mold. Seed nuts should not be allowed to become dry after being gathered, and when kept over winter they may be preserved in a box alternating in single layers with moist sand. Holes should be made in the bottom of the box to allow excess moisture to escape. The top should be covered with wire netting to avoid the ravages of rodents and the whole placed in the open ground, some knoll or other spot being selected for this purpose and the box buried about 6 or 8 inches deep.

When possible, it is best to plant the seed where the tree is expected to grow, since the long tap root of the chestnut renders it somewhat difficult to transplant. Otherwise the seeds are planted in a seed bed in rows wide enough apart to permit of easy cultivation. The following spring they may be planted in the nursery in rows 4 feet apart and about 18 inches distant in the row. In transplanting, the tap root should be pruned back to about one-half its length and all side branches of the stem removed. Frequent cultivation should follow during the summer.

It is generally advisable to allow the stocks to remain in the nursery rows at least two seasons before they are grafted, or until they have attained a size of from three-eighths to one-half inch in diameter, 3 or 4 feet from the ground. Valuable stocks can often be secured from natural seeding in the forest or from the sprouts of cut-over chestnut lands; in fact, the usual method of growing chestnuts on a commercial scale is by grafting the sprouts arising about the stumps of such forests with the European or Japanese varieties.

At the Connecticut State Station the best time for grafting was found to be from May 15 to June 15. Whip grafts on small stocks made the best union. Cleft grafting is desirable for large stocks. Foliage should be left around the graft to protect it from the sun's rays. When the grafting is skillfully performed, it can be reasonably expected that about 50 per cent of the scions will grow.

The chestnut orchard should be located on well-drained gravelly soil for best results. It succeeds well on rocky hillsides with soil of sufficient looseness and depth, and with either a northern or eastern exposure. It will thrive on rather poor sand, but is slow and uncertain on stiff clayey soils, although excellent results are reported from the California Station with Italian chestnuts on heavy clays. In general it is considered more important to have a thoroughly drained soil than soil of a particular character.

Trees in the permanent orchard, when of the European variety, should be set not less than 40 feet, and when of the Japanese, not less than 30 feet, apart each way. They are usually pruned to an open spreading form, with 3 to 5 main branches, and cultivation given similar to that of a young apple orchard.

Grafted chestnut trees grow rapidly and Japanese varieties frequently set fruit the first year of the insertion of the scion. Both Japanese and European varieties frequently bear heavy loads of burrs the second year. It is advisable to pick off all fruits for the first three or four years in order that the energy of the tree may be devoted to the production of a vigorous growth of wood and a well-established root system before reproduction begins.

Nuts are prepared for the market by first plunging in scalding water for 15 minutes and thoroughly stirring. The wormy nuts rise to the top of the water and are removed, after which the water is drained off and the nuts dried in the sun or in the drying house to prevent molding. It is advisable to grade nuts for the general market, as the price of a lot is regulated by the size of the smallest nuts.

The chestnut tree has a number of insect enemies which attack the leaves and wood; but apparently the most serious injury is done by weevils which work in the fruit. The Delaware Station suggests as means of controlling these insects that orchards be planted away from native chestnut forests; all worms and wormy nuts destroyed; the beetles caught by jarring, as for the plum curculio; and a few trees planted in the orchard which attract the weevils, all the fruit from these trees being destroyed.

It is claimed that Japanese varieties are less affected by fungus diseases than European and American varieties, which are frequently total failures from this cause. Experiments at the Delaware Station indicate that one of the most troublesome of these diseases, viz, leaf blight, may be controlled by spraying trees with three or four applications of Bordeaux mixture. A disease similar to sun scald sometimes affects trees in the nursery. Imported seedlings appear to be especially liable to this disease; hence it is best to grow European and Japanese seedlings in America.

The advantages of growing Japanese varieties are, according to the Delaware Station, as follows: The trees make perfect unions on American stocks, are easily cared for, come into early bearing, are

practically free from blights, have considerable ornamental value, and are enormously productive, while the fruit ripens early and is of large size. The nuts, however, are often of poor quality and the trees subject to overbearing if not thinned. Some of the better varieties are Alpha, Reliance, and Parry. Alpha is considered the earliest known variety of chestnut.

European varieties are valuable for the finer appearance and quality of their nuts. Some varieties are very productive and the tree has considerable timber value. They, however, come into bearing considerably later than the Japanese varieties and are frequently attacked by leaf blights. The young trees are often shy bearers, the nuts ripen later and are more subject to weevil attacks, and commercial groves do not yield the money returns which are derived from Japanese groves. One of the best European varieties is Paragon. The trees of this variety are prolific, the nuts large and of good quality. Other valuable varieties are Numbo and Ridgely.

FOOD VALUE.

In the recent bulletin of the Maine Station, the composition and food value of chestnuts and other nuts is discussed.

In France, where the chestnut is widely grown, the nut has come to play an important part in the dietaries of the poor. The common way of preparing the nuts is to remove the shells and steam them, when they may be eaten either with salt or milk, furnishing a cheap and nutritious food. Thus prepared, the hot nuts are sold in the streets, and form the chief morning dish for a large proportion of the working classes. Large quantities of the nuts are also dried and ground to a flour, which can be kept for some time without deteriorating. This flour, mixed with water and baked in thin sheets, forms a heavy, but sweet and nutritious cake. The use of the chestnut is not confined to the poor, since it is used in many forms by the well-to-do who prepare from them many palatable dishes.

In Italy the use of the chestnut is also very general. The nut is eaten fresh, boiled and roasted, or as a substitute for corn meal in the "polenta," a form of porridge much used by the poorer people. A common delicacy in the Apennines is "necci," flat cakes of chestnut flour and water, baked between hot, flat stones, with chestnut leaves between the cakes. In Korea the chestnut is said almost to take the place which the potato occupies with us, being used raw, boiled, roasted, cooked with meat, or dried whole.

In addition to the uses of chestnuts as food noted above, the following dishes may be mentioned: Chestnut soup, purée, chestnut stuffing for turkey and other fowls, chestnut gravy, chestnuts and spinach, and a number of desserts, including purée with cream, chestnuts cooked in sirup and served with cream, "pain de marrons," "parfait" of chestnuts (a kind of ice cream), and cakes thickly covered with a sort of chestnut icing or cream. The candied chestnuts or "marron glacé" of the confectioners are well known. Indeed, the most common uses of chestnuts in this country are probably for making "marron glacé" and the stuffing for fowls, and for roasting. The receipts for preparing the various dishes from chestnuts may be found in standard books devoted to cookery.

The following table shows the composition of a number of varieties of chestnuts, the composition of flour, potatoes, and cabbage being also included for purposes of comparison. The values given include both the material as purchased and the edible portion:

Composition of the chestnut and other foods.

Variety and condition.	Refuse.	Water.	Protein.	Fat.	Total carbohydrates.	Ash.
Chestnuts:						
Edible portion—	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Numbo, fresh *a*		42.2	6.1	6.6	43.3	1.8
Moon Seedling, fresh *a*		41.7	6.3	6.4	43.8	1.8
Solebury, fresh *a*		29.2	6.7	8.3	54.0	1.8
Native, fresh *a*		34.4	8.0	10.8	45.1	1.7
Italian, fresh *b*		53.8	6.6	2.0	36.9	.7
Italian, fresh *b*		52.7	4.1	2.0	40.4	.8
Variety unknown, fresh *c*		44.9	7.3	8.0	38.3	1.5
Average, fresh nuts		42.7	6.5	6.3	43.1	1.4
Spanish, dry *a*		6.6	9.0	6.6	75.0	2.8
Paragon, dry *a*		6.5	11.4	9.1	70.1	2.9
Spanish, dry *a*		5.4	10.3	9.1	72.5	2.7
Native, dry *a*		4.8	11.6	15.3	65.7	2.6
Average, dry nuts		5.8	10.6	10.0	70.8	2.8
As purchased—						
Numbo, fresh *a*	11.5	37.3	5.4	5.9	38.3	1.6
Moon Seedling, fresh *a*	14.3	35.7	5.4	5.5	37.5	1.6
Solebury, fresh *a*	15.3	24.8	5.7	7.0	45.7	1.5
Native, fresh *a*	23.2	26.4	6.2	8.3	34.6	1.3
Italian, fresh *b*	15.4	45.5	5.6	1.7	31.2	.6
Italian, fresh *b*	15.5	44.5	3.5	1.7	34.1	.7
Average, fresh nuts	15.9	35.7	5.3	5.0	36.9	1.2
Spanish, dry *a*	21.5	5.2	7.0	5.2	58.9	2.2
Paragon, dry *a*	23.9	5.0	8.7	6.9	53.3	2.2
Spanish, dry *a*	25.3	4.0	7.7	6.8	54.2	2.0
Native, dry *a*	22.9	3.7	8.9	11.8	50.7	2.0
Average, dry nuts	23.4	4.5	8.1	7.7	54.2	2.1
Wheat flour *d*		12.8	10.8	1.1	74.8	.5
Cabbage:						
Edible portion *d*		91.5	1.6	.3	5.6	1.0
As purchased *d*	15.0	77.7	1.4	.2	4.8	.9
Potatoes:						
Edible portion *d*		78.3	2.2	.1	18.4	1.0
As purchased *d*	20.0	62.6	1.8	.1	14.7	.8

a Pennsylvania Sta. Bul. 16, p. 15.
b California Sta. Rpts. 1895–96; 1896–97, p. 153; Bul. 113, p. 7.
c Massachusetts State Sta. Rpt. 1893, p. 354.
d U. S. Dept. Agr., Office of Experiment Stations Bul. 28 (revised).

It will be seen that the most abundant nutrient in chestnuts is carbohydrates (largely starch). They also contain fairly large amounts of protein and fat. Comparing their composition with that of flour, for example, it will be found that chestnuts are relatively rich in nutritive matter. As the Maine Station states, "the chestnut differs widely from the other common nuts, since it contains much less oil and protein and much more of the carbohydrates, especially starch, which is almost wholly wanting in many nuts."

Only a few experiments have been made on the digestibility of nuts. It is quite commonly believed that oily nuts are not easily digested. According to experiments recently made in Italy, chestnuts are quite thoroughly digested. The subject of the experiments was a healthy man who consumed chestnuts cooked in a number of different ways for several days, taking no other food. The digestibility of the chestnuts

expressed in per cent was as follows: Dry matter, 93.8; protein, 74.7; fat, 86.7; carbohydrates, 96.7. According to the Italian investigator, the chestnuts were most completely digested when they were cooked until soft.

In the Maine bulletin on nuts quoted above it is stated that when chestnuts sell for 5 cents per quart, 10 cents' worth of chestnuts will furnish 0.62 pound of protein, 1,340 calories. In a recent publication of this Department, it is stated that at 6 cents per pound 10 cents' worth of beef shoulder would furnish 0.27 pound of protein, 1,270 calories; at 2 cents per pound 10 cents' worth of wheat flour would furnish 0.55 pound of protein, 8,225 calories; and at 1 cent per pound 10 cents' worth of potatoes would furnish 0.18 pound of protein, 3,200 calories.

From what has been stated it is evident that chestnuts are a nutritious food of reasonable cost, which may be prepared in a number of ways. As their value becomes better known, their use will probably become more extended.—C. B. SMITH AND C. F. LANGWORTHY.

LOW-GRADE PARIS GREEN.

It has been observed by entomologists and fruit growers that the results obtained by the use of Paris green varied to a considerable extent. The California Station has recently made some investigations to determine the cause of this variation in the effectiveness of Paris green as an insecticide, as well as of the damage to foliage often noted as a result of its use.

As a result of these studies, three classes of unsatisfactory Paris green are recognized: Bogus, adulterated, and low grade. By bogus Paris green is meant out-and-out imitations of the substance in which the color is due to other substances than copper, and in which there is little trace of either copper or arsenic, which are the essential constituents of pure Paris green. It is not believed that much Paris green of this nature is upon the market. By adulterated Paris green is meant that to which some other cheaper and usually nonpoisonous substance has been added for the purpose of increasing the weight, for example, gypsum and flour. By a low-grade Paris green is meant a Paris green which contains a low percentage of arsenic. To raise the percentage of arsenic in such grades of Paris green, it is customary to add free arsenious acid ("white arsenic"). Such a mixture, however, is very harmful for spraying purposes, because arsenious acid is soluble to a considerable extent in water, and for this reason is likely to injure the foliage. This injury can not always be prevented by the addition of lime, which has been generally recommended for this purpose.

In several States laws have been passed which establish a standard for Paris green. These laws, however, simply require that Paris green shall contain a fixed amount of arsenic (50 per cent) without specifying its form. It is evident from the above facts that to be of the greatest

benefit to fruit growers the inspection should take into consideration the form of the arsenic in the Paris green. One of the chief advantages of pure Paris green as an insecticide is its slight solubility in water and the consequent possibility of using it in considerable quantities without injuring the foliage of plants. When, however, deficiency in arsenic content is made good with a soluble form of arsenic, the value of the substance as an insecticide is greatly reduced.

There is considerable difference of opinion as to the extent of such adulteration. Of 24 samples of Paris green examined during 1899 by the New York State Station in compliance with the State law providing for inspection of this article only one or two showed evidence of admixture of white arsenic. This station states that "the color of Paris green is changed to such an extent by addition of white arsenic or other similar materials that one can usually detect an adulterated article by its appearance. Paris green of good quality is intensely bright green and uniform. When adulterated, the green loses something of its intensity and is grayish green and is not always uniform."—E. V. WILCOX.

CRUDE PETROLEUM AS AN INSECTICIDE.

During the past few years the San José scale has caused so much alarm among the fruit growers of this and other countries that entomologists have devoted a large amount of attention to the development of effective methods of controlling it. The unusually energetic efforts which have been put forth in this direction have resulted in the production of methods which are useful against a number of other insects as well as against the San José scale. Besides the method of fumigation with hydrocyanic-acid gas, various washes and spraying solutions have been applied with more or less success against scale insects. Kerosene oil diluted and undiluted has been experimented with in a number of States, and recently crude petroleum has attracted attention as a remedy against the San José scale. A rather extensive series of experiments with this substance was recently conducted by Prof. J. B. Smith at the New Jersey Station, the results of which were such that a number of fruit growers were asked to make experiments on their own orchards, in order to determine whether the crude oil could be safely used as a spray or wash by the average horticulturist.

The trees treated with crude oil included all the ordinary fruit trees except the cherry, and numbered about 4,000. The crude oil was applied as a wash and as a spray. In the form of a spray it was used undiluted and also diluted with water in various proportions. These treatments were at first made during the winter, but later the oil was tried as a summer spray. Considerable injury resulted, however, from its use upon the foliage of fruit trees during the growing season. The station therefore concludes that "crude petroleum is not suited for a summer application, either pure or diluted," but that for use in winter "it is fully as effective against scale insects as kerosene, and is harmless

to the most tender varieties and on the youngest trees. * * * As the oil remains on the surface for a long time, it makes no difference whether it is put on undiluted or mixed with water." When the crude oil is applied in an undiluted form the station recommends that an apparatus which makes a fine spray (Vermorel nozzle) be used for its application. When this is not practicable, it is suggested by Professor Smith that equally good results may be obtained by using an apparatus (forms of which are found on the market) which thoroughly mixes the oil and water as it is applied, the oil being diluted with 60 to 75 per cent of water.—E. V. WILCOX.

SKIM MILK IN BREAD MAKING.

It is a common practice in many households to use more or less milk for mixing bread dough, since it is believed that the quality of the bread is thereby improved. Frequently skim milk is used instead of whole milk. Doubtless comparatively few persons realize that skim milk has a fairly high food value and that its use makes bread more nutritious, in addition to improving its quality. It must be remembered that when the cream is removed the milk is deprived of only one of its constituents, namely, fat. It still contains practically all the highly nutritious casein and other nitrogenous materials, as well as the milk sugar and ash originally present, in addition to about 0.3 per cent of fat (good whole milk contains from 3 to 5 per cent fat).

A recent report of the Maine Station says in effect that the value of skim milk as a food is not generally appreciated. Taken by itself it is "rather thin," and one has to drink a large quantity to get the needed nourishment. Further, it is so readily assimilated that it does not long satisfy the sense of hunger. But when taken with bread or used in cooking it is a valuable food material. A pound of lean beef contains about 0.18 pound of protein or nitrogenous material, whose principal function is the formation of tissue (especially muscle), and has a fuel value (which is taken as a measure of the energy it will produce) of 870 calories. Two and one-half quarts or five pounds of skim milk will furnish the same amount of protein and have nearly the same fuel value as a pound of round steak. Two quarts of skim milk has a greater nutritive value than a quart of oysters. This amount of skim milk contains 0.14 pound of protein and has a fuel value of 680 calories, while the oysters contain only 0.12 pound of protein and have a fuel value of 470 calories.

According to a recent report in the journal of the British Dairy Farmers' Association, skim milk materially increases the yield of bread and consequently the profits in bread making. It was found that 280 pounds of flour would take up 175 pounds of water in mixing the dough and yield 94 four-pound loaves, there being a loss of 71 pounds of water during baking. The same quantity of flour would take up 210 pounds of skim milk and yield 110 four-pound loaves, the shrinkage during

baking in this case being 50 pounds. The water bread is said to sell for 10 cents and the milk bread for 11 cents per loaf. Assuming that the above quantity of skim milk was worth $1.64, the skim-milk bread would yield a profit of 86 cents more than the water bread.

At its annual show held in London in October, 1899, the association conducted tests on the value of skim milk for making scones and pancakes. The dough for the scones was made from 14 pounds of American flour, 11 pounds of sour skim milk, 3 ounces of bicarbonate of soda, and 3 ounces of cream of tartar. This dough was cut into pieces weighing 6 ounces, rolled out, and baked on a hot iron plate, yielding 25 pounds of scones. The mixture for pancakes was similar in composition but thinner, 14 pounds of flour being mixed with 16 pounds of skim milk and the same amount of leavening material as before. This batter was cooked on a hot greased plate, yielding 30 pounds of cakes, there being practically no evaporation in baking. The large amount of skim milk utilized in proportion to the flour is noteworthy. If the scones and cakes are sold, the skim milk has practically the same commercial value as the flour, since very nearly equal quantities of the two materials were used.

The Maine Station has recently studied the comparative value of bread made with water and with skim milk. The average composition of the two sorts of bread was found to be as follows:

Composition of bread made with water and with skim milk.

Kind of bread.	Water.	Protein (N × 6.25)	Fat.	Carbohydrates.	Ash.	Heats of combustion (fuel value).
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Calories.*
Water bread	39.44	8.93	1.07	49.69	0.87	2,694
Skim-milk bread	37.97	9.98	.94	49.82	1.29	2,710

It will be seen that the bread made with skim milk contains about 1 per cent more protein than that made with water.

Experiments conducted in Switzerland some years ago showed that skim-milk bread was quite completely digested, differing little from other bread in this respect. The Maine Station compared the two kinds of bread by digesting them with a pepsin solution. It was found that they differed very little, somewhat over 94 per cent being digested in each case.

It thus appears that skim-milk bread contains more protein than water bread, and is as completely digested as the latter.

The Maine Station points out the fact that the use of skim milk in bread making utilizes a valuable waste product of the dairy, and calls attention to other profitable uses which may be made of it in the household, as follows:

In the preparation of soups, such as potato, celery, tomato, green pea, and green corn soups; fish, lobster, clam, and oyster chowders, bisques and stews, skim milk

will [satisfactorily] replace the whole milk that the directions for preparing usually call for. Skim milk makes as good white soups as whole milk. Bread mixed with skim milk is more nutritious than that made with water. All kinds of quick biscuit, griddle cakes, etc., can be made with skim as well as with whole milk. In most kind of cake skim milk will be found a perfect substitute for whole milk. If the skim milk is sour, so much the better for cake and quick bread making, as only half the cream of tartar called for in the recipe will be needed.

Sweet skim milk can be used to advantage in making rice and Indian puddings, custards, squash and pumpkin pies, and the like, in the preparation of chocolate or cocoa as a drink, in the making of sherbets and other ices, and in dozens of other ways which will readily occur to housekeepers.

—C. F. LANGWORTHY.

THE NUMBER OF LAYING HENS THAT MAY BE PROFITABLY KEPT IN ONE PEN.

It is a matter of importance to determine how many laying hens may be profitably kept in a poultry house. It is especially important in those regions where the climate is such that carefully constructed buildings are required for the proper housing of fowls in winter. The opinion is quite generally held that when kept in yards or allowed to roam at will hens do best in flocks of about 40 or 50, and that when confined in winter quarters each laying hen requires about 10 square feet of floor space. The size of the flock which may be profitably kept in a pen of definite size has been recently reported upon by the Maine Station. The station poultry building contained 15 pens alike in size and arrangement of window space, and gravel, bone, and water dishes. The pens were 10 by 16 feet, and the entire floor space of 160 square feet was available, since the walk used by the attendants was elevated above the floor. The tests were made with 4 lots of 15 pullets each, 4 lots of 20, 4 lots of 25, and 3 lots of 30. The breeds selected were Brahma and Barred Plymouth Rocks, there being 8 lots of the former and 7 of the latter. With each breed the lots contained from 15 to 30 individuals. The experimental conditions would give the lots containing 15 pullets 10.6 square feet of floor space each, the lots containing 20 pullets 8 square feet each, those containing 25 pullets 6.4 square feet, and those containing 30 pullets 3.5 square feet. Care was taken to have the individuals in the lots as uniform as possible in form, size, and vigor. All the pullets were hatched early in May, with the exception of one lot of 15 which was hatched about two weeks earlier. The test began in November and continued six months. Careful records of the egg production, etc., were kept. The results with the different lots of the same size were found to be quite uniform. The table below summarizes the more important results.

Results of tests with different-sized lots of hens.

Number of hens in each pen.	Average floor space per hen.	Number of eggs produced per hen during six months.	Number of eggs produced per pen.	Value of eggs produced per pen at 2 cents each.	Value of food consumed per pen at average of 50 cents per hen.	Income per pen less cost of food (six months).	Net income per hen during six months.	Net income per hen per square foot of floor space.
	Sq. feet.							*Cents.*
15	10.6	65.1	976	$19.52	$7.50	$12.02	$0.80	7.5
20	8.0	60.4	1,208	24.16	10.00	14.16	.71	8.9
25	6.4	51.4	1,284	25.68	12.50	13.18	.53	8.3
30	3.5	40.1	1,203	24.06	15.00	9.06	.30	8.6

The table shows that "the lots containing 20 hens gave a greater total net profit per lot than did those containing any greater or less number of hens. Lots with 25 hens gave slightly greater net returns than did the 15-hen lots. The lots that had 30 hens each gave very much less net returns than did any of the others." The average net profit per hen, however, steadily decreased as the number of hens per pen increased, being 80 cents per hen during six months with the lots of 15 and only 30 cents with the lots of 30.

The tests indicate in general that the best results will be obtained by allowing each hen from 8 to 10 feet of floor space.—C. F. LANGWORTHY.

A NEST BOX FOR KEEPING INDIVIDUAL EGG RECORDS.

It is often desirable to record exactly the egg production of individual fowls. Numerous appliances and patented devices for this purpose are on the market—some practically worthless, others of varying degrees of usefulness. The Maine Station has recently published a description of a nest box which is claimed to be simple, inexpensive, easy to attend to, and certain in its action.

It is a box-like structure, without front end or cover. It is 28 inches long, 13 inches wide, and 13 inches deep—inside measurements. A division board with a circular opening 7½ inches in diameter is placed across the box 12 inches from the back end and 15 inches from the front end. The back section is the nest proper. Instead of a close door at the entrance, a light frame of inch by inch and a half stuff is covered with wire netting of 1-inch mesh. The door is 10½ inches wide and 10 inches high and does not fill the entire entrance, a space of 2½ inches being left at the bottom and 1½ inches at the top, with a good margin at each side to avoid friction. If it filled the entire space it would be clumsy in its action. It is hinged at the top and opens up into the box. The hinges are placed on the front of the door rather than at the center or back, the better to secure complete closing action.

The trip consists of one piece of stiff wire about three-sixteenths of an inch in diameter and 18½ inches long, bent as shown in the drawing. A piece of board 6 inches wide and just long enough to reach across the box inside is nailed flatwise in front of the partition and 1 inch below the top of the box, a space of one-fourth of an inch being left between the edge of the board and the partition. The purpose of this board is only to support the trip wire in place. The 6-inch section of the trip wire is placed across the board and the long part of the wire slipped through the quarter-inch slot, and passed down close to and in front of the center of the 7½-inch circular opening. Small wire staples are driven nearly down over the 6-inch section

of the trip wire into the board so as to hold it in place and yet let it roll sidewise easily.

When the door is set, the half-inch section of the wire marked A comes under a hard-wood peg or a tack with a large round head, which is driven into the lower edge of the door frame. The hen passes in through the circular opening, and in doing so presses the wire to one side, and the trip slips from its connection with the door. The door promptly swings down and fastens itself in place by its lower edge striking the light end of a wooden latch or lever, pressing it down and slipping over it, the lever immediately coming back into place and locking the door. The latch is 5 inches long, 1 inch wide, and a half inch thick, and is fastened loosely 1 inch from its center to the side of the box, so that the outer end is just inside of the door when it is closed. The latch acts quickly enough to catch the door before it rebounds. It was feared that the noise arising from the closing of the door might startle the hens, so instead of wooden stops, pieces of old rubber belting were nailed at the outside entrances for the door to strike against.

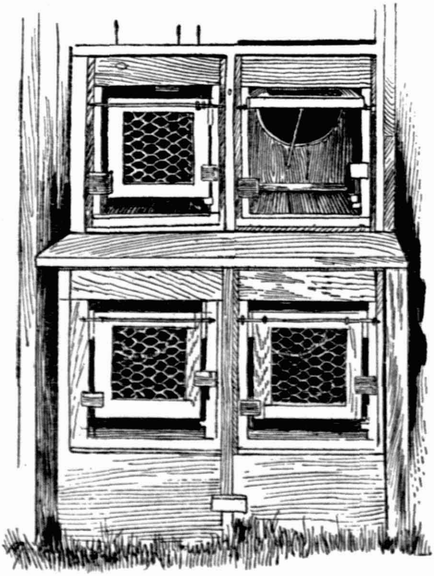

FIG. 4.—Nest boxes for obtaining egg records of individual hens.

The double box with nest in the rear end is necessary, as when a bird has laid and desires to leave the nest, she steps to the front and remains there until released. With one section only, she would be very likely to crush her egg by standing upon it.

The boxes, which have no tops, are arranged in cases in groups of four and slide in and out like drawers (see fig. 4). They may, of course, be used singly by simply providing a cover for each box. When a hen has laid, the nest is pulled part way out or the cover lifted, as the case may be, and the hen removed. Each hen has a band bearing a number attached to her leg and the eggs may be numbered to correspond.

The Maine Station has made use of these nests in experiments undertaken to establish families of hens that shall excel as egg producers. The laying stock is to be bred from the eggs of hens showing a large egg production. The breeds employed in the experiments undertaken thus far are Barred Plymouth Rocks, White Wyandottes, and Light Brahmas.

The same method might be employed with advantage in practice to weed out unproductive hens from a flock and to select for breeding only those which are good egg producers.—C. F. LANGWORTHY.

PROFITABLE AND UNPROFITABLE COWS.

"Good judges believe that in the entire country one-third of the cows kept for their milk do not pay for their cost of keeping, and nearly a third more fail to yield annual profit." This rather startling statement was made in the Yearbook of this Department about five years ago by one who is competent to speak upon the question. It is possible that in the meantime the condition of the dairy stock has improved somewhat, but the writings of the experiment stations and the continual agitation of the subject which is kept up by the agricultural press do not indicate that there has been any very widespread improvement. The general proposition is true beyond dispute that a considerable proportion of the dairy cows of the country are kept either at an actual loss or so small a profit as to give very little net return. This is usually due to lack of exact information as to the quantity and quality of milk produced by individual cows, and the approximate cost of production. The work of a number of the experiment stations in studying the cows kept by their farmer constituents has brought out wide variations in the productiveness and profitableness of the cows of their herds.

HOW DAIRY COWS DIFFER.

The Connecticut Storrs Station within the past few years has tested the cows of 32 different herds in the State of Connecticut. It reports that—

> Many of the individual cows in the test were not returning the cost of the feed. The average yield of milk ranged from 13.2 to 23.4 pounds per day, while the average yield of butter ranged from 0.7 pound to 1.33 pounds per day. This means that the herd giving the largest flow of milk was producing 80 per cent more than the one giving the smallest flow, while the herd producing the most butter was giving 90 per cent more than the one giving the smallest yield of butter. * * * One of the first things our dairymen need to do is to make a closer study of the individual animals of their herds and to reject the unprofitable ones.

Likewise, the Wisconsin Station made a series of tests during the past year of the herds of six patrons furnishing milk to the dairy school creamery. These patrons had never kept any record of the yield or quality of the milk of their cows. These herds, it is stated "are undoubtedly a fair representation of the 840,000 cows that produce the butter and cheese of this State." The individual cows of four herds were tested through one entire period of lactation. At farm "A" the annual yield of milk ranged from 3,792 to 6,203 pounds, and of butter fat from 147 to 296 pounds. At farm "B" the milk yield ranged from 5,193 to 7,887 pounds, and the butter fat from 245 to 312 pounds. At farm "C" the milk yield ranged from 4,411 to 8,132 pounds, and the butter fat from 222 to 336 pounds. At farm "D" the range of milk was from 4,847 to 6,570 pounds, and of butter fat from 223 to 300 pounds. At farm "A" there were three cows which did not produce milk enough to pay for their feed. The entire herd of twelve cows gave a profit of only $75; $50 of this amount was from three of

the cows, while the combined profit from the other nine was only $25. The twelve cows on farm "C" earned a total profit of $228, instead of $75 as on farm "A," but even on this farm there was considerable difference in the cows. The value of the product from the poorest cow was $37.96, and from the best $60.72. The best cow gave a profit of about $31, while the poorest gave a profit of only $8.

The herds at several of the experiment stations have purposely been made up of good average cows, such as many farmers possess, but including some of lower grade. Hence the records of these station herds often illustrate the marked differences between good and ordinary or poor cows. A record for one year of the herd of 25 cows at the Connecticut Agricultural College shows that the annual yield of milk varied in the case of different individuals from 3,141 to 8,558 pounds, and the annual yield of butter from 165 to 509 pounds. This herd included 4 registered Jerseys, 3 Guernseys, 4 Ayrshires, and the balance were mostly Jersey and Guernsey grades, "perhaps better than the average run of dairy cows." The best cow gave a profit (above the cost of feed) of $42.82, while the poorest cow gave a loss of $4.09. The average profit for the whole herd was $15.50 per cow. Eleven of the 25 cows did not come up to the average, and 8 of these gave a profit of less than $10. Two of the cows were kept at an actual loss, while nearly half of them materially reduced the average for the whole herd.

These figures are a striking illustration of the difference in the profit from cows which would ordinarily pass for good dairy animals. The best cow, giving a profit of $42.82, was nearly three times as profitable to keep as the average cow of the herd; i. e., she gave a profit equal to 3 such cows.

For the past three or four years the New Jersey Station has conducted a dairy experiment on practical lines, using a herd of grade cows. With milk at $1 per hundred the best cow gave a profit of $49.72, while the poorest cow gave a profit of only 13 cents. With butter at 20 cents a pound the best cow paid for her feed and $46.64 additional, while the poorest cow gave only $5.84 in addition to the cost of the feed.

> The facts brought out by this study strongly emphasize the correctness of the claim that but little profit is derived from a cow that does not produce 5,000 pounds of milk per year, particularly if the milk is sold at the low price of 1 cent per pound, * * * and indicate that there is but little profit derived from a cow that does not produce 200 pounds of butter per year. * * * No stronger argument is needed in favor of the necessity of testing animals, and thus learning their exact value, and of the selection of dairy cows, than is afforded by the above records.

The average cost of keeping a cow a year has been variously estimated by experiment stations in different localities at from $30 to $45. If a cow gives just sufficient return to pay the cost of her keeping, she furnishes merely a home market for a part of the farmer's crops, and the value of the manure may be taken to offset the labor of caring for her. As a matter of fact, the manure too often offsets both the labor

and the profit. But while this item must be taken into account in estimating the profit, the farmer can not afford to keep cows for their manure. Every dollar's worth of product above that required to cover the cost of maintenance is just so much clear gain, and the value of a cow increases rapidly with her ability to widen this difference between cost and value of product. As the New Jersey Station has pointed out, nearly the same capital and practically the same amount of labor are required whether the return from the herd is large or small; and from every point of view a good small herd is much more profitable than a large poor one.

WHAT THE DAIRYMAN SHOULD DO.

Granting these facts, the question arises what the farmer with a herd of dairy cows is to do. First of all he should find out not only what his herd collectively, but what each cow, is doing. In other words, he should begin a record of both the quantity and the quality of milk produced by each cow. After this record has been kept for a while it will show him what cows are giving a good return and will enable him to systematically weed out his herd, retaining only the best cows. He should then gradually raise the standard of his herd by the introduction of new stock or by breeding his best cows to good bulls. The means for keeping the record and making this selection are now available to every dairyman. The Babcock test, which is a simple means of determining the richness of the milk in fat, and the scales for determining the yield of milk, enable any farmer to ascertain the value for milk and butter production of each cow in his herd, and whether she is a source of profit or of loss. (Fig. 5.)

The scales will show the total amount of milk produced in a year, but this alone is not a safe basis for judging of the value of a cow. A large milk yield may easily mislead the owner if the fat test is not made. For gauging the true value of the cow both the yield of milk and its fat content must be known. The work of the experiment stations has demonstrated repeatedly that the amount of butter fat produced by a cow in her milk is an accurate measure of her value for butter making, and is likewise a close indication of her value for cheese making. The amount of fat is quite generally recognized by both creameries and cheese factories as the fairest basis for buying milk, although some, unfortunately, continue to buy according to the weight of milk.

The practical method of using the Babcock test in making a herd record has been the subject of numerous experiments at the stations, such as the frequency of testing, use of composite samples, etc. The fat test may be made at frequent intervals, say once a week; or a composite test can be made by taking a small sample of milk each day, mixing these, and testing the mixture at the end of a week. Since the milk given in the morning usually differs somewhat from that given at

night, it is more reliable to take samples of both the morning's and the night's milk for testing. By keeping a continuous record of the weight of milk produced, and making a composite test of the milk for one week in each month, a very close estimate of the milk and butter production of the cow will be secured. A test of the mixed morning's and night's milk of the cow for one day in each week will give approximately the amount and will answer for practical purposes. The test may be made less frequently, but is not as accurate. If a cow has been found to give 200 pounds of milk in one week and the test for that period shows the

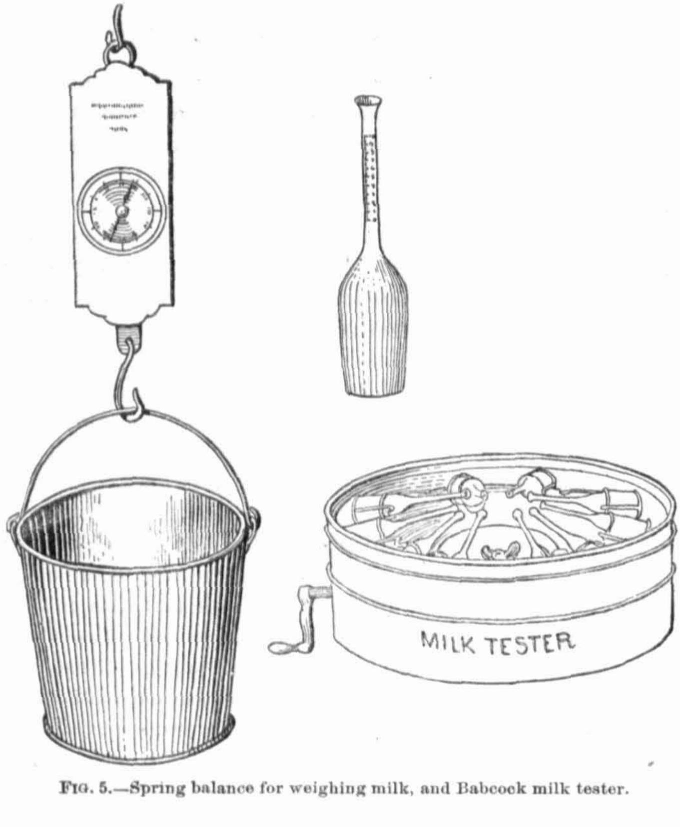

FIG. 5.—Spring balance for weighing milk, and Babcock milk tester.

milk to contain 4.25 per cent of fat, the total amount of butter fat produced in the week would be 8½ pounds. The approximate amount of butter can be calculated by adding one-sixth to the butter fat, which is the rule usually followed by the experiment stations.

The amount of labor involved in keeping this record when once fitted up for it is small, and, from a pecuniary point of view, it is well worth the undertaking. It shows whether or not the farmer is boarding the cow and drawing on the profit from the better cows in order to do it. No amount of guesswork can take its place.

GRADING UP THE HERD.

Having made the record for each cow, the poorer cows which are not paying for their keeping should be sold for beef, and calves raised from only the best cows in the herd.

An illustration of the grading up of a herd from the ordinary cows of the neighborhood is furnished by the New York Cornell Station. The herd consists of about 20 cows, mostly grade Jerseys and grade Holsteins. It has been developed from the ordinary stock of the neighborhood by the use of thoroughbred bulls and a rigid selection of the best heifers. In 1874 the average yield of milk per cow was a little more than 3,000 pounds. The descendants of these cows produced in the year 1897–98 an average of over 7,500 pounds of milk per cow.

This increase of two and one-half times is the result of judicious selection of sire and dam, together with careful feeding, and is the result which every farmer can obtain by following a similar course.

Since the introduction of the Babcock test a careful record has been kept of the amount of butter fat produced by the herd.

Each cow's milk is weighed daily and once a week a sample of an equal amount of night's and morning's milk is taken from each cow. The fat in these samples of mixed milk is determined by the Babcock test, and this percentage multiplied by the number of pounds of milk given during the week is taken to represent the number of pounds of fat produced during that week. Although this method does not give the actual amount of fat produced, still it gives a very close approximation thereto, and is sufficiently accurate for practical purposes in estimating the producing power of any individual cow.

For seven years past the average annual yield of milk fat by this herd has been over 275 pounds per cow, which would be equivalent to nearly 325 pounds of butter. The heifers selected from the best cows are milked at least one year, and only such as give promise of being profitable are retained.

This process of selection is still going on. The difference in cost of production is still very large. For instance, the cost of 100 pounds of milk varied from 44 cents to $1.48, the average being 62½ cents; and the cost of butter fat ranged with different cows from 11 to 27 cents, the average being 15.8 cents.

Results along similar lines have been obtained at a number of other experiment stations, and the practicability of raising the standard of production by careful selection and intelligent breeding is attested by the experience of a large number of progressive dairymen throughout the country.

PROPER CARE AND FEEDING.

Proper feeding and care count for a great deal in milk production, and may do much to improve the milking qualities of otherwise poor cows. Consequently before a cow is rejected the farmer should be sure that the fault for low production lies with the cow herself, and not with the feed and care she has received. At the Kansas Experi-

ment Station a herd of 20 common scrub cows, which "were below the average cows of the State," were tested to see what could be made of them by proper handling. The average yield of milk per cow under such handling was 5,707 pounds, the poorest cow giving 3,583 pounds; and the average yield of butter fat was 238 pounds, the poorest cow giving 135.7 pounds. The value of the butter fat averaged $37.75 per cow. To compare this with the conditions in the State, the records were collected of 82 herds in one of the leading dairy sections. The average annual yield was found to be 3,441 pounds of milk per cow, and 104.5 pounds of butter fat, the value of which was $19.79.

We attribute the greater yield secured from the college scrub herd to three causes: First, at all times their rations were either balanced or contained an excess of protein—the material which builds blood and milk—while the Kansas cow usually, when on dry feed, has only half enough protein. Second, kindness and shelter. Our scrub cows were petted, comfortably sheltered, never driven faster than a slow walk, and never spoken to in an unkind tone. Third, a full milk yield was secured through the summer drought by giving extra feed.

The importance of rational feeding and care to bring out all there is in a cow is very strongly urged by Prof. T. L. Haecker, of the Minnesota Station, who goes so far as to say that, for the time being, it is "of greater importance to the average dairyman than breed or type." He has found in his work that "the average cow in Minnesota is returning in dairy products a sum barely equal to the market price of the feed, simply because of a lack of understanding of how to feed." The average gross return for all the common cows at the Minnesota Station, which "are no better than the average cow of Minnesota," was valued at $44.53 per cow. The average gross return to farmers of the State, as shown by the creamery returns, was only about $22 per cow. This deficiency of $22.53 in the returns from the common cows of the State, Professor Haecker believes it is fair to conclude is "wholly due to lack of knowledge of proper feeding and care."

It is of the first importance, therefore, that the farmer should be sure he is making the most of the cows he has before beginning to weed out his herd. Having assured this by feeding not only a sufficiently large amount of food, but sufficient protein, a standard should be fixed upon for yield of milk and butter fat, and all cows which do not come up to this should be discarded. What this standard shall be at the outset will depend upon the quality of the average cows comprising the herd, as shown by the record, but it should at least be one which will give a fair profit.—E. W. ALLEN.

EXPLANATION OF TERMS.

TERMS USED IN DISCUSSING FERTILIZERS.

Complete fertilizer is one which contains the three essential fertilizing constituents, i. e., nitrogen, phosphoric acid, and potash.

Nitrogen exists in fertilizers in three distinct forms, viz, as organic matter, as ammonia, and as nitrates. It is the most expensive fertilizing ingredient.

Nitrates furnish the most readily available forms of nitrogen. The most common are nitrate of soda and nitrate of potash (saltpeter).

Nitrification is the process by which the highly available nitrates are formed from the less active nitrogen of organic matter, ammonia, salt, etc. It is due to the action of minute microscopic organisms.

Phosphoric acid, one of the essential fertilizing ingredients, is derived from materials called phosphates. It does not exist alone, but in combination, most commonly as phosphate of lime in the form of bones, rock phosphate, and phosphatic slag. Phosphoric acid occurs in fertilizers in three forms—soluble, reverted, and insoluble phosphoric acid.

Superphosphate.—In natural or untreated phosphates the phosphoric acid is insoluble in water and not really available to plants. Superphosphate is prepared from these by grinding and treating with sulphuric acid, which makes the phosphoric acid more available to plants. Superphosphates are sometimes called acid phosphates.

Potash, as a constituent of fertilizers, exists in a number of forms, but chiefly as chlorid or muriate and as sulphate. All forms are freely soluble in water and are believed to be nearly, if not quite, equally available, but it has been found that the chlorids may injuriously affect the quality of tobacco, potatoes, and certain other crops. The chief sources of potash are the potash salts from Stassfurt, Germany—kainit, sylvinit, muriate of potash, sulphate of potash, and sulphate of potash and magnesia. Wood ashes and cotton-hull ashes are also sources of potash.

TERMS USED IN DISCUSSING FOODS AND FEEDING STUFFS.

Water is contained in all foods and feeding stuffs. The amount varies from 8 to 15 pounds per 100 pounds of such dry materials as hay, straw, or grain to 80 pounds in silage and 90 pounds in some roots.

Dry matter is the portion remaining after removing or excluding the water.

Ash is what is left when the combustible part of a feeding stuff is burned away. It consists chiefly of lime, magnesia, potash, soda, iron, chlorin, and carbonic, sulphuric, and phosphoric acids, and is used largely in making bones. Part of the ash constituents of the food is stored up in the animal's body; the rest is voided in the urine and manure.

Protein (nitrogenous matter) is the name of a group of substances containing nitrogen. Protein furnishes the materials for the lean flesh, blood, skin, muscles, tendons, nerves, hair, horns, wool, casein of milk, albumen of eggs, etc., and is one of the most important constituents of feeding stuffs.

Albuminoid nitrogen is nitrogen in the form of **albuminoids**, which is the name given to one of the most important groups of substances classed together under the general term protein. The albumen of eggs is a type of albuminoids.

Amid nitrogen is nitrogen in the form of **amids**, one of the groups of substances classed together under the general term **protein.** Amids, unlike albuminoids, are usually soluble in water, but are generally considered of less value as food than albuminoids.

Carbohydrates.—The nitrogen-free extract and fiber are often classed together under the name of carbohydrates. The carbohydrates form the largest part of all vegetable foods. They are either stored up as fat or burned in the body to produce heat and energy. The most common and important carbohydrates are sugar and starch.

Fiber, sometimes called crude cellulose, is the framework of plants, and is, as a rule, the most indigestible constituent of feeding stuffs. The coarse fodders, such as hay and straw, contain a much larger proportion of fiber than the grains, oil cakes, etc.

Nitrogen-free extract includes starch, sugar, gums, and the like, and forms an important part of all feeding stuffs, but especially of most grains.

Fat, or the materials dissolved from a feeding stuff by ether, is a substance of mixed character, and may include, besides real fats, wax, the green coloring matter of plants, etc. The fat of food is either stored up in the body as fat or burned, to furnish heat and energy.

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